PATENT ABSTRACTS OF JAPAN

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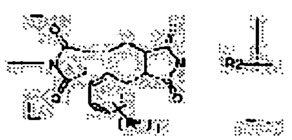
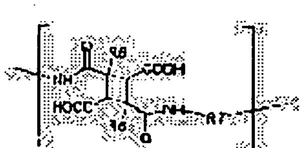
(54) LIQUID CRYSTAL ALIGNMENT AGENT AND LIQUID CRYSTAL DISPLAY ELEMENT

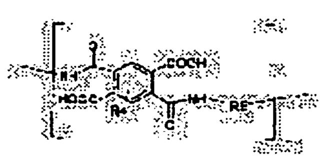


I

II



III



IV

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a liquid crystal alignment agent which is excellent in jetting stability in applying to a substrate by ink jet printing and gives a liquid crystal alignment layer having a uniform thickness by incorporating a block copolymer containing polyimide blocks and polyamic acid blocks into the same.

SOLUTION: This agent contains a block copolymer comprising polyimide blocks and polyamic acid blocks. The polyimide block comprises at least one kind of repeating units selected from among repeating units represented by formulas I and I. The polyamic acid block comprises at least one kind of repeating units selected from among repeating units represented by formulas III and IV. In the formulas, R1, R4, and R6 are each H or alkyl; R2, R3, R5, and R7 are each a divalent organic group; 1 is 1-4; and n, m, q, and p are each a

positive number, The agent can quite satisfy the pretilt angle, voltage retention, and residual image characteristics required of liquid crystal display elements.

LEGAL STATUS

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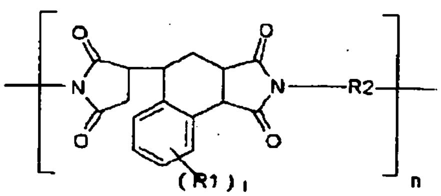
CLAIMS

[Claim(s)]

[Claim 1] It is the block copolymer which comes to contain the 1st polyimide block and the 2nd polyamic acid block in a molecule, and said 1st polyimide block is the following type (1).

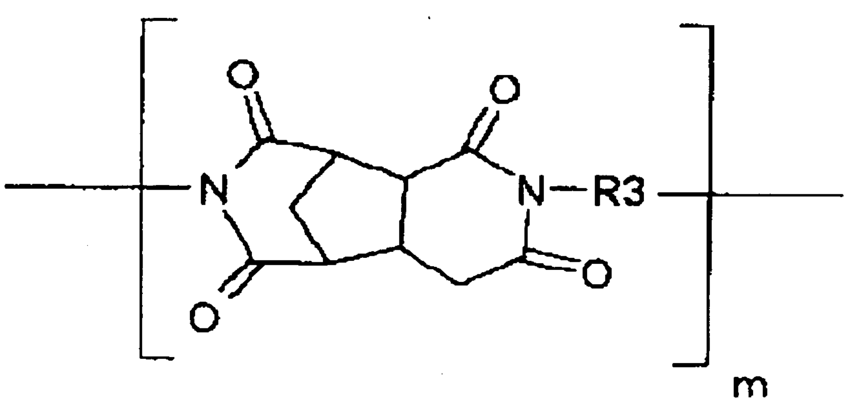
[Formula 1]



... (1)

the repeat unit which R1 shows a hydrogen atom or an alkyl group, R2 shows a divalent organic radical here, and l shows the integer of 1-4, and n shows the repeat number of unit, and is a positive number and which is come out of and expressed, and the following type (2)

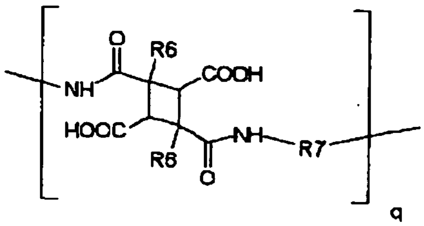
[Formula 2]



... (2)

at least one sort of repeat units chosen from the group which R3 is a divalent organic radical, and m shows the repeat number of unit, and consists of a repeat [which is a positive number] unit come out of and expressed here — containing — becoming — and said 2nd polyamic acid block — the following formula (3)

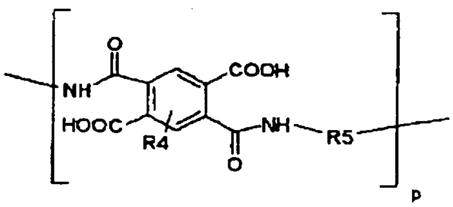
[Formula 3]



. . . (3)

the repeat unit which R6 shows a hydrogen atom or an alkyl group, and R7 shows a divalent organic radical here, and q shows the repeat number of unit, and is a positive number and which is come out of and expressed, and the following type (4)

[Formula 4]



. . . (4)

the liquid crystal orientation agent characterized by containing the block copolymer which comes to contain at least one sort of repeat units chosen from the group which R4 shows a hydrogen atom or an alkyl group, and R5 shows a divalent organic radical here, and p shows a repeat unit, and consists of a repeat [which is a positive number] unit come out of and expressed.

[Claim 2] The liquid crystal display component characterized by having the liquid crystal orientation film obtained using a liquid crystal orientation agent according to claim 1.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the liquid crystal display component using a liquid crystal orientation agent and it suitable as a formation agent of the liquid crystal orientation film. Furthermore, this invention relates to the liquid crystal display

component using the liquid crystal orientation agent and it which show the spreading stability which was excellent when applying to a substrate by ink jet print processes, and thickness homogeneity by containing the block copolymer of specific structure in detail.

[0002]

[Description of the Prior Art] As current and a liquid crystal display component, form the liquid crystal orientation film which consists of polyimide etc. in the front face concerned of the substrate with which the transparence electric conduction film is prepared, and it considers as the substrate for liquid crystal display components. Carry out opposite arrangement of the two sheets, and form the layer of the nematic mold liquid crystal which has a forward dielectric anisotropy in the gap, and it considers as the cel of sandwich structure. The TN liquid crystal display device to which it was made for the major axis of the liquid crystal molecule concerned to be continuously twisted 90 degrees toward the substrate of another side from one substrate and which has the so-called TN (Twisted Nematic) mold liquid crystal cell is known. The CRT monitor glue of the former [panel / so-called / which operated this TN liquid crystal display device by TFT drive / TFT-liquid-crystal] is spreading widely. In this liquid crystal device, the liquid crystal orientation film is controlling the orientation of liquid crystal. By the flexographic printing method, to the substrate, the liquid crystal orientation film is carrying out spreading-baking of the polyamic acid solution which is the precursor of polyimide, and the polyimide solution meltable to a solvent, and is forming them.

[0003] However, by the flexographic printing method, since the complicatedness of a maintenance of the printing version -- the printing version must be exchanged according to a substrate — has been regarded as questionable, ink jet print processes attract attention recently. By the ink jet method, there is a merit; like the maintenance free's of the printing version and a pattern setup of printing being free and a liquid crystal orientation agent solution are little, and it is good, and the cost cut of a liquid crystal panel and the yield improvement are expected.

[0004]

[Problem(s) to be Solved by the Invention] Although ink jet print processes had the above merits, the liquid crystal orientation agent suitable for this was not yet proposed, but had the trouble that the stable printing condition could not be held from viewpoints, such as the viscosity property of damage on the ink jet printing machine by the solvent used, polyimide, and a polyamic acid solution, in conventional polyimide and polyamic acid.

[0005] (1) It is necessary to make a liquid crystal orientation agent blow off from a detailed nozzle at high speed, and the viscosity property of a liquid crystal orientation agent serves as an important factor in ink jet print processes. That is, resistance when external force strong against a solution is applied be excellent in a fluidity few. Moreover,

it is also important that the organic material may be used for the nozzle member in part, and a liquid crystal orientation agent does not commit this organic material, and it needs to lessen strong soluble solvent contents, such as N-methyl pyrrolidone conventionally used as a solvent of a liquid crystal orientation agent. It is thought that the soluble high polyamic acid system ingredient to various solvents is suitable from such a viewpoint.

[0006] (2) On the other hand, the military requirement as liquid crystal orientation film is becoming still more advanced, and serves as demand level which is traded off with single ingredients, such as high-voltage retention, a high pre tilt angle, and the low residual DC. The technique which mixes the polyamic acid which excels the low residual DC, and the polyimide which excels high-voltage retention and a high pre tilt angle as a means to cancel these trade-ofves is known.

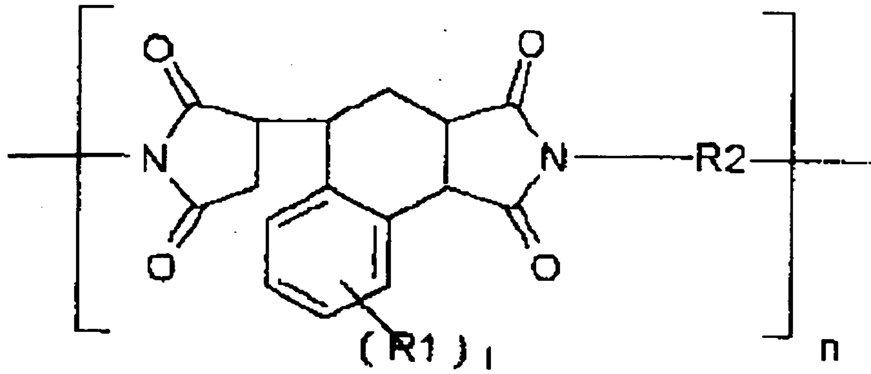
[0007] It is expected from the situation of the above (1) and (2) that the polyamic acid and the polyimide complex which are excellent in a fluidity and solubility are suitable as an object for ink jet printing. However, in having only mixed polyimide with polyamic acid by research of this invention person, both dissociated with the share and heat at the time of ink jet printing, and to become a cause lacking in jet stability and the engine-performance stability as liquid crystal orientation film was shown clearly. So, in this invention, it succeeded in manufacture of the liquid crystal orientation agent excellent in jet stability, the engine-performance stability of the liquid crystal orientation film, and the stability over ink jet equipment by making the polyamic acid and polyimide containing specific structure compound-ize using the technique of block copolymerization.

[0008] That is, the purpose of this invention is to offer the liquid crystal display component using a new liquid crystal orientation agent and new it. Other purposes of this invention are to offer the liquid crystal display component using the liquid crystal orientation agent and it which come to contain the block copolymer which consists of a polyamic acid block and a polyimide block. The purpose of further others of this invention is to offer the liquid crystal display component using a liquid crystal orientation agent and it excellent in jet stability, the engine-performance stability of the liquid crystal orientation film, and the stability over ink jet equipment. The purpose and advantage of further others of this invention will become clear from the following explanation.

[0009]

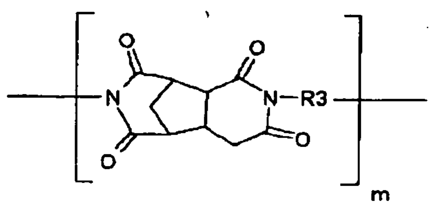
[Means for Solving the Problem] According to this invention, the above-mentioned purpose and advantage of this invention are a block copolymer which comes to contain the 1st polyimide block and the 2nd polyamic acid block in a molecule, and said 1st polyimide block is the following formula (1).

[Formula 5]



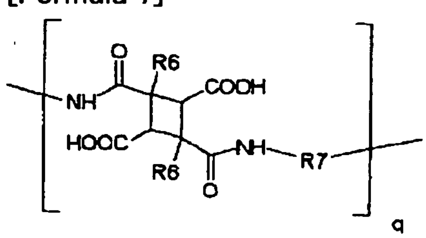
. . . (1)

the repeat unit which R1 shows a hydrogen atom or an alkyl group, R2 shows a divalent organic radical here, and l shows the integer of 1-4, and n shows the repeat number of unit, and is a positive number and which is come out of and expressed, and the following type (2)
[Formula 6]



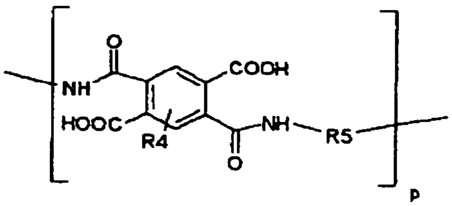
. . . (2)

at least one sort of repeat units chosen from the group which R3 is a divalent organic radical, and m shows the repeat number of unit, and consists of a repeat [which is a positive number] unit come out of and expressed here — containing — becoming — and said 2nd polyamic acid block — the following formula (3)
[Formula 7]



. . . (3)

the repeat unit which R6 shows a hydrogen atom or an alkyl group, and R7 shows a divalent organic radical here, and q shows the repeat number of unit, and is a positive number and which is come out of and expressed, and the following type (4)
[Formula 8]

 . . . (4)

it is attained by the liquid crystal orientation agent characterized by containing the block copolymer which comes to contain at least one sort of repeat units chosen from the group which R4 shows a hydrogen atom or an alkyl group, and R5 shows a divalent organic radical here, and p shows a repeat unit, and consists of a repeat [which is a positive number] unit come out of and expressed.

[0010] Hereafter, this invention is explained concretely. The liquid crystal orientation agent of this invention comes to contain the block copolymer which consists of the 2nd polyamic acid block which has the repeat unit indicated to be the 1st polyimide block which has the repeat unit shown by said formula (1) and/or formula (2) by said formula (3) and/or formula (4) which were combined with this.

[0011] In said formula (1), R1 is a hydrogen atom or an alkyl group. An alkyl group may be a straight chain-like, or may be branched-chain, and the alkyl group of carbon numbers 1-30 is mentioned preferably. Moreover, R2 is a divalent organic radical and is a divalent desirable alicyclic radical or a desirable divalent divalent aromatic series radical. As a divalent alicyclic radical or a divalent divalent aromatic series radical, the divalent residue excluding the amino group from the alicyclic diamine or aromatic series diamine mentioned later, for example can also be mentioned. The repeat numbers of unit n are usually 3-2,000 preferably, and are 3-100 more preferably.

[0012] In said formula (2), R3 is a divalent organic radical and is a divalent desirable alicyclic radical or a desirable divalent divalent aromatic series radical. As these examples, the same thing as it of the above R2 can be mentioned. The repeat numbers of unit m are 3-2,000 preferably, and are 3-100 more preferably.

[0013] Moreover, in said formula (3), R6 is a hydrogen atom or an alkyl group. An alkyl group may be a straight chain-like, or may be branched-chain, and can mention the alkyl group of carbon numbers 1-30 preferably. R7 is a divalent organic radical and is a divalent desirable alicyclic radical or a desirable divalent divalent aromatic series radical. As a divalent alicyclic radical or a divalent divalent aromatic series radical, the divalent residue excluding the amino group from the alicyclic diamine or aromatic series diamine mentioned later, for example can be mentioned. The repeat numbers of unit q are 2-1,000 preferably, and are 2-100 more preferably.

[0014] Furthermore in a formula (4), R4 is a hydrogen atom or an alkyl group. An alkyl group may be a straight chain-like, or may be branched-chain, and can mention the alkyl

group of carbon numbers 1–30 preferably.

[0015] R5 is a divalent organic radical and is a divalent desirable alicyclic radical or a desirable divalent divalent aromatic series radical. As these examples, the same thing as it of the above R7 can be mentioned. The repeat numbers of unit p are 2–1,000 preferably, and are 2–100 more preferably.

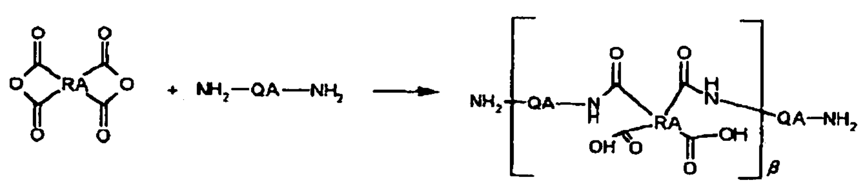
[0016] Furthermore, as for the weight ratio (rho 1) of the 1st polyimide block in a block copolymer, and the weight ratio (rho 2) of the 2nd polyamic acid block, it is desirable that it is rho1<rho2, and in rho1>rho2, the viscosity in a high share may be excessive, may not be suitable for ink jet spreading, and may be inferior to thickness homogeneity in leveling nature bad also in the usual flexographic printing method.

[0017] The <manufacture approach of a block copolymer>, next the manufacture approach of the block copolymer of this invention are explained. The block copolymer of this invention can be manufactured by performing the "process C" which makes "Process B" and said polyamic acid prepolymer (A), and said polyimide prepolymer (B) for preparing the polyimide prepolymer (B) which has the reactant radical which originates in "Process A" and ** molecule end for preparing the polyamic acid prepolymer (A) which has an amino group at tetracarboxylic acid react to ** molecule end. moreover — although it is also more possible than the polyamic acid prepolymer of a tetracarboxylic acid end, and the polyimide prepolymer of an amino-group end to obtain the block copolymer of this invention — the repeat number of unit of a prepolymer — aging — carrying out — **** — the approach of things to the processes A, B, and C is desirable. Processes A, B, and C are explained to an example below.

[0018] Process A: The tetracarboxylic acid which has the organic radical RA in this process A as shown in the following reaction formula 1, and organic radical QA The diamine which it has is made to react. the mol of the tetracarboxylic acid used — a number — receiving — diamine — the mol — the polyamic acid prepolymer (A) of the repeat number of unit beta which has an amino group at the molecule end is prepared by using with the excessive amount beyond this molar quantity so that a number may become 1.001 to twice.

[0019]

[Formula 9]

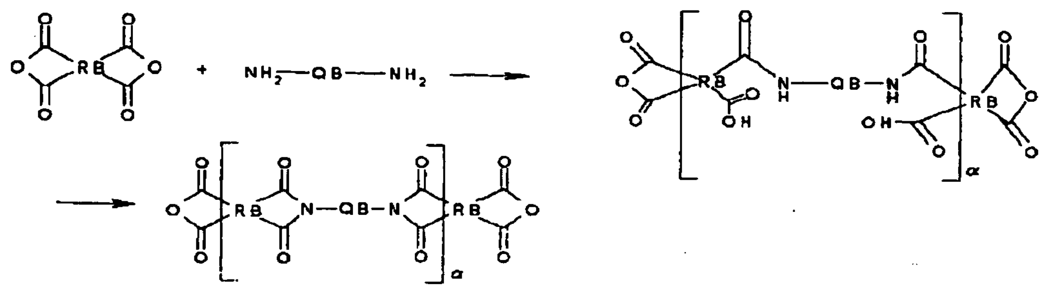


[0020] Process B: The tetracarboxylic acid which has the organic radical RB in this process B as shown in the following reaction formula 2, and organic radical QB The

diamine which it has is made to react. To the number of mols of the diamine used, the polyamic acid which has the reactant radical which originates in a molecule end at tetracarboxylic acid is prepared by using with the excessive amount beyond this molar quantity so that the number of mols may become 1.001 to twice about tetracarboxylic acid. Subsequently, imide-ized processing mentioned later is performed and the polyimide prepolymer (B) of the repeat number of unit alpha is obtained.

[0021]

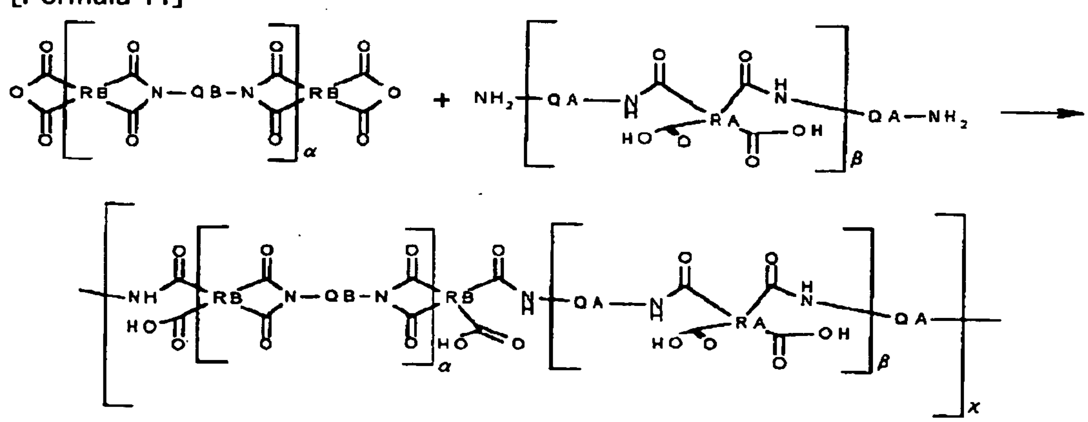
[Formula 10]



[0022] Process C : The end amino group of the polyamic acid prepolymer (A) obtained at Process A in this process C, By making the reactant radical originating in the tetracarboxylic acid of the end of the polyimide prepolymer (B) obtained at Process B react like Process A or Process B As shown in a reaction formula 3, it is the nucleus atomic group RA. Organic radical QA combined through the divalent joint radical (-CO-NH-) The polyamic acid block which repeats combination and is made into a unit (A), The block copolymer with which it comes to combine the polyimide block (B) which repeats the combination of the same nucleus group RB and the organic radical QB, and is made into a unit is manufactured.

[0023]

[Formula 11]



[0024] Moreover, in Process C, it is the following approach and the block copolymer

obtained can also be used as the block copolymer of the end qualified type with which molecular weight was adjusted. The block copolymer of this end qualified type is applicable to the improvement of a spreading property etc. The thing of such an end qualified type is compoundable by adding acid 1 anhydride, a monoamine compound, a mono-isocyanate compound, etc. to the system of reaction of Process C. Here, as acid 1 anhydride, a maleic anhydride, phthalic anhydride, itaconic acid anhydride, n-DESHIRUSAKUSHI nick acid anhydride, n-dodecyl SAKUSHI nick acid anhydride, n-tetradecyl SAKUSHI nick acid anhydride, n-hexadecyl SAKUSHI nick acid anhydride, etc. can be mentioned, for example. As a monoamine compound, for example Moreover, an aniline, cyclohexylamine, N butylamine, n-pentylamine, n-hexylamine, n-heptyl amine, n-octyl amine, n-nonyl amine, n-DESHIRU amine, n-undecyl amine, n-dodecyl amine, n-tridecyl amine, n-tetradecylamine, An n-pentadecyl amine, n-hexadecyl amine, an n-heptadecyl amine, n-octadecyl amine, n-EIKO sill amine, 3-aminopropyl trimethoxysilane, 3-aminopropyl triethoxysilane, 2-aminopropyl trimethoxysilane, 2-aminopropyl triethoxysilane, 3-ureido propyltrimethoxysilane, 3-ureido propyl triethoxysilane, N-(2-aminoethyl)-3-aminopropyl trimethoxysilane, N-(2-aminoethyl)-3-aminopropyl methyl dimethoxysilane, 3-aminopropyldimethylmethoxysilane, 3-aminopropyl methyldiethoxysilane, p-[N-(2-aminoethyl) aminomethyl] phenethyl trimethoxysilane, N, and N-bis[3-(trimethoxysilyl) propyl] ethylenediamine, an N-3-trimethoxysilylpropyl-m-phenylenediamine, etc. can be mentioned. Moreover, as a mono-isocyanate compound, phenyl isocyanate, naphthyl isocyanate, 3-isocyanate propyl triethoxysilane, etc. can be mentioned, for example.

[0025] It is possible to use together and use two or more compounds out of the compound illustrated below as the tetracarboxylic acid used in Process A or Process B and diamine. In addition, the block copolymer with which it comes to contain three or more sorts of blocks can also be manufactured making more than one sort or it of the polyamic acid prepolymer manufactured like Process A or Process B, and/or a polyimide prepolymer react in Process C, or by making it react like Process C.

[0026] As an example of the tetracarboxylic dianhydride used at Process A, it is 1, 2, 3, 4-cyclobutane tetracarboxylic dianhydride, 1, and 2-dimethyl. - It is 1, 2, 3, 4-cyclobutane tetracarboxylic dianhydride, 1, and 3-dimethyl. - It is 1, 2, 3, 4-cyclobutane tetracarboxylic dianhydride, 1, 2 and 3, and 4-tetramethyl. - As being chosen out of 1, 2, 3, 4-cyclobutane tetracarboxylic dianhydride, and pyromellitic acid 2 anhydride, one sort can be preferably used as it is few

[0027] moreover, as an example of the tetracarboxylic dianhydride used at Process B The 1, 3,a [3], 4, 5, and 9b-hexahydro-5(tetrahydro - 2, 5-dioxo-3-furanyl)-[1 and 2-naphth c]-furan -1, 3-dione, 1, 3, 3a, 4, 5, 9b - The hexahydro-5-methyl-5(tetrahydro

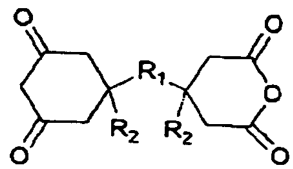
– 2, 5–dioxo–3–furanyl)–[1 and 2–naphth c]–furan –1, 3–dione, 1, 3, 3a, 4, 5, 9b – The hexahydro–5–ethyl–5(tetrahydro – 2, 5–dioxo–3–furanyl)–[1 and 2–naphth c]–furan –1, 3–dione, 1, 3, 3a, 4, 5, 9b – The hexahydro–7–methyl–5(tetrahydro – 2, 5–dioxo–3–furanyl)–[1 and 2–naphth c]–furan –1, 3–dione, 1, 3, 3a, 4, 5, 9b – The hexahydro–7–ethyl–5(tetrahydro – 2, 5–dioxo–3–furanyl)–[1 and 2–naphth c]–furan –1, 3–dione, 1, 3, 3a, 4, 5, 9b – The hexahydro–8–methyl–5(tetrahydro – 2, 5–dioxo–3–furanyl)–[1 and 2–naphth c]–furan –1, 3–dione, 1, 3, 3a, 4, 5, 9b – The hexahydro–8–ethyl–5(tetrahydro – 2, 5–dioxo–3–furanyl)–[1 and 2–naphth c]–furan –1, 3–dione, 1, 3, 3a, 4, 5, 9b–hexahydro –5, the 8–dimethyl–5(tetrahydro – 2, 5–dioxo–3–furanyl)–[1 and 2–naphth c]–furan –1, 3–dione, As being chosen out of 2, 3, and 5–TORIKARUBOKI gardenia fruit clo pentyl acetic–acid 2 anhydride, one sort can be preferably used as it is few. Moreover, in Process A and Process B, the range which does not spoil the description of this invention, and the desirable tetracarboxylic dianhydride these acid 2 anhydrides and below–mentioned can be used together by the amount not more than 20 mol % of all the tetracarboxylic dianhydride used, and it can use.

[0028] As a tetracarboxylic acid anhydride used together and used in Process A and/or Process B, the alicyclic tetracarboxylic dianhydride and aromatic series tetracarboxylic dianhydride which are illustrated below can be mentioned. Moreover, in Process A, the tetracarboxylic dianhydride illustrated as what is used at Process A in Process B in the tetracarboxylic dianhydride illustrated as what is used at Process B may be used by the amount used not more than 20 mol %, respectively.

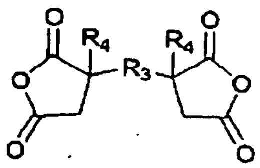
[0029] As alicyclic tetracarboxylic dianhydride, it is 1 and 3–dichloro, for example. – 1, 2, 3, 4–cyclobutane tetracarboxylic dianhydride, 1, 2, 3, 4–cyclopentane tetracarboxylic dianhydride, 1, 2 and 4, 5–cyclohexane tetracarboxylic dianhydride, 3, 3', 4, 4'–dicyclohexyl tetracarboxylic dianhydride, 3, 5, 6–TORIKARUBOKISHI norbornane–2–acetic–acid 2 anhydride, 2, 3 and 4, 5–tetrahydrofuran tetracarboxylic dianhydride, The 5–(2, 5–dioxo tetrahydro FURARU)–3–methyl–3–cyclohexene –1, 2–dicarboxylic acid 2 anhydride, Bicyclo [2, 2, 2]–oct–7–en – The compound expressed with 2, 3, 5, 6–tetracarboxylic dianhydride, the following type (5), and (6) is mentioned.

[0030]

[Formula 12]



. . . (5)



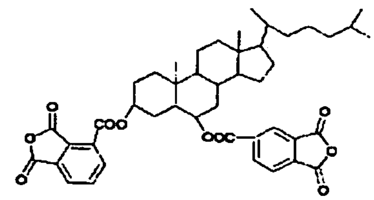
. . . (6)

(R1 and R3 show among a formula the divalent organic radical which has aromatic series, R2 and R4 show a hydrogen atom or an alkyl group, and even if R2 and R4 existing [two or more] are the same respectively, they may differ)

[0031] As aromatic series tetracarboxylic dianhydride, for example 3, 3', 4, 4'-benzophenone tetracarboxylic dianhydride, 3, 3', 4, 4'-biphenyl sulfone tetracarboxylic dianhydride, 1, 4, 5, 8-naphthalene tetracarboxylic dianhydride, 2, 3 and 6, 7-naphthalene tetracarboxylic dianhydride, 3, 3', 4, 4'-biphenyl ether tetracarboxylic dianhydride, 3, 3', 4, 4'-dimethyl diphenyl silane tetracarboxylic dianhydride, 3,3',4,4'-tetraphenylsilane carboxylate dianhydride, 1, 2, 3, 4-furans tetracarboxylic dianhydride, 4, and 4'-bis(3, 4-dicarboxy phenoxy) diphenyl sulfide 2 anhydride, 4 and 4'-bis(3, 4-dicarboxy phenoxy) diphenylsulfone 2 anhydride, 4 and 4'-bis(3, 4-dicarboxy phenoxy) diphenyl propane 2 anhydride, 3, 3', 4, and 4' - perfluoro isopropylidene JIFUTARU acid — 2 anhydride 3, 3', 4, 4'-biphenyl tetracarboxylic dianhydride, bis(phthalic acid) phenyl phosphine oxide 2 anhydride, p-phenylene-bis(triphenyl phthalic acid) 2 anhydride, m-phenylene-bis(triphenyl phthalic acid) 2 anhydride, A screw (triphenyl phthalic acid) -4, 4'-diphenyl ether 2 anhydride, A screw (triphenyl phthalic acid) -4, 4'-diphenylmethane 2 anhydride, An ethylene glycol-screw (anhydrotrimellitate), a propylene glycol-screw (anhydrotrimellitate), A 1,4-butanediol-screw (anhydrotrimellitate), a 1,6-hexanediol-screw (anhydrotrimellitate), A 1, 8-octanediol-screw (anhydrotrimellitate), 2, and 2-bis(4-hydroxyphenyl) propane-screw (anhydrotrimellitate), the compound expressed with following type (7) - (10) are mentioned.

[0032]

[Formula 13]



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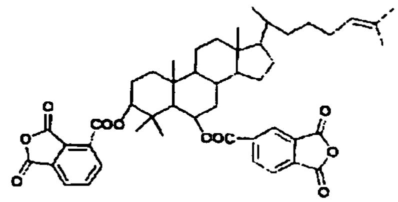

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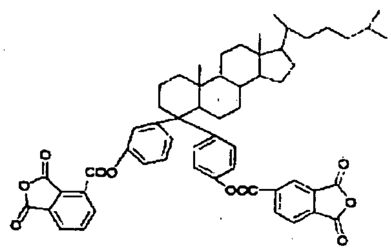

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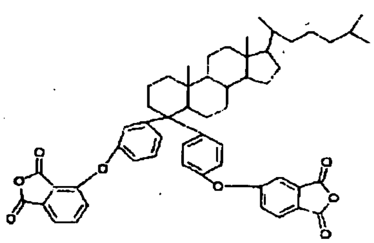


. . . (10)

[0033] As a diamine compound used in Process A and/or Process B, an aliphatic series diamine compound, an aromatic series diamine compound, etc. can be mentioned. As an aliphatic series diamine compound, for example 1 and 1-meta-xylylene diamine, 1,3-propanediamine, a tetramethylenediamine, pentamethylene diamine, A hexamethylenediamine, heptamethylene diamine, octamethylene diamine, Aliphatic series diamines, such as nonamethylene diamine, 4, and 4-diamino heptamethylene diamine; 1, 4-diamino cyclohexane, Isophorone diamine, tetrahydro dicyclopentadienylene diamine, Hexahydro -4, 7-methano INDANIREN dimethylene diamine, and tricyclo [6. 2.1.02, 7]-undecylene dimethydiamine, 4 and 4'-methylenebis (cyclohexylamine), 1, 3-screw aminomethyl cyclohexane, Alicyclic diamines, such as 2, 5-bis(aminomethyl) bicyclo [2.2.1] heptane, 2, and 6-bis(aminomethyl) bicyclo [2.2.1] heptane; the diamino ORGANO siloxane expressed with the following type (11) is mentioned.

[0034]

[Formula 14]

$$H_2N\left(CH_2\right)_r Si(R^9)(R^9)\left(O-Si(R^9)(R^9)\right)_s\left(CH_2\right)_r NH_2 \quad \cdots (11)$$

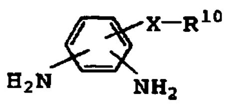
(R9 shows the hydrocarbon group of carbon numbers 1-12 among a formula, even if R9 existing [two or more] is the same respectively, you may differ, and r is the integer of 1-3, and s is the integer of 1-20.)

[0035] As an aromatic series diamine compound, p-phenylene diamine, m-phenylenediamine, - diamino diphenylmethane, and 4 and 4 '4, 4'-diamino bibenzyl, - diamino diphenyl sulfide, and 4 and 4 '4, 4'-diaminodiphenyl sulfone, 4 and 4'-diamino diphenyl ether, 3, 5-diamino benzoic acid, 1-hexa deca NOKISHI -2, 4-diaminobenzene, 3, the 3'-dimethyl -4, a 4'-diamino biphenyl, - diamino benzanilide, and 4 and 4 '4, 4'-diamino diphenyl ether, The 1, 5-diamino naphthalene, 3, and 3-dimethyl -4, a 4'-diamino biphenyl, 5-amino-1-(4'-aminophenyl)- a 1, 3, and 3-trimethyl indan — 6-amino-1-(4'-aminophenyl)- a 1, 3, and 3-trimethyl indan — A - diamino diphenyl ether, and 4 '3, 3'-diamino benzophenone, [3, and] 3, a - diamino benzophenone, and 4 '4, 4'-diamino benzophenone, A 2 and 2-bis[4-(4-amino phenoxy) phenyl] propane, 2 and 2-bis[4-(4-amino phenoxy) phenyl] hexafluoropropane, 2 and 2-screw (4-aminophenyl) - 1, 1, 1, 3, 3, and 3-hexafluoropropane, A 2 and 2-bis[4-(4-amino phenoxy) phenyl] sulfone, 1, 4-bis(4-amino phenoxy) benzene, 1, 3-bis(4-amino phenoxy) benzene, A 1, 3-bis(3-amino phenoxy) benzene, 9, and 9-bis(4-aminophenyl)-10-hydronalium anthracene, A 2, 7-diamino fluorene, 9, and 9-bis(4-aminophenyl) fluorene, 4 and 4 - methylenebis (2-chloroaniline), 2, 2', and '5, 5' - tetra-chloro -4 and 4' - diamino biphenyl — 2, 2'-dichloro -4, the 4'-diamino -5, a 5'-dimethoxy biphenyl, 3, 3'-dimethoxy -4, a 4'-diamino biphenyl, 3, 3'-dicarboxy - 4 4'-diamino biphenyl, 3 and 3'-dihydroxy -4, - diamino biphenyl, and 4 '4, 4'-(p-phenylene diisopropylidene) dianyline, - (m-phenylene diisopropylidene) dianyline, and 4 and 4 '2, 2' bis[-] [4-(4-amino-2-trifluoro methylphenoxy) phenyl] hexafluoropropane, 4, the 4'-diamino -2, a 2'-bis(trifluoromethyl) biphenyl, Aromatic series diamines, such as a 4 and 4'-screw [(4-amino-2-trifluoromethyl) phenoxy]-octafluoro biphenyl; 2, 3-diamino pyridine, 2, 6-diamino pyridine, 3, 4-diamino pyridine, 2, 4-diamino pyrimidine, 5, the 6-diamino -2, 3-dicyano pyrazine, 5, 6-diamino-2,4-dihydroxypyrimidine, 2, 4-diamino-6-dimethylamino-1,3,5-triazine, 1, a 4-bis(3-aminopropyl) piperazine, 2, 4-diamino-6-isopropoxy-1,3,5-triazine, 2, 4-diamino-6-methoxy-1,3,5-triazine, 2,

4-diamino-6-phenyl-1,3,5-triazine, 2, 4-diamino-6-methyl-s-triazine, 2, 4-diamino-1,3,5-triazine, 4, 6-diamino-2-vinyl-s-triazine, 2, a 4-diamino-5-phenyl thiazole, 2,6-diaminopurine, 5, the 6-diamino -1, 3-dimethyl uracil, 3, 5-diamino - 1, 2, 4-triazole, 6, 9-diamino-2-ethoxy acridine lactate, 3, 8-diamino-6-phenyl phenanthridine, 1, 4-diamino piperazine, Diamine which has nitrogen atoms other than two the 1st class amino groups and these the 1st class amino groups in intramoleculars, such as a compound expressed with 3, 6-diamino acridine, bis(4-aminophenyl) phenylamine, and following type (12) - (13);

[0036]

[Formula 15]

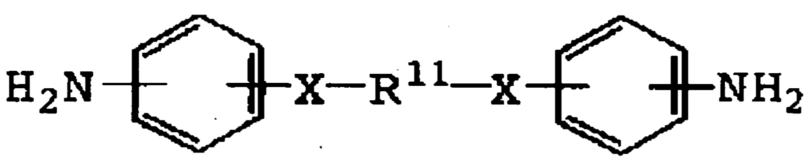


...(12)

(Among a formula, R10 shows the univalent organic radical which has a ring structure containing the nitrogen atom chosen from a pyridine, a pyrimidine, triazine, a piperidine, and a piperazine, and X shows a divalent organic radical.)

[0037]

[Formula 16]



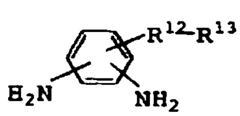
...(13)

(Even if X which R11 shows the divalent organic radical which has a ring structure containing the nitrogen atom chosen from a pyridine, a pyrimidine, triazine, a piperidine, and a piperazine, and X shows a divalent organic radical among a formula, and exists is the same, it may differ.)

[0038] Mono-permutation phenylenediamines expressed with the following type (14);

[0039]

[Formula 17]



...(14)

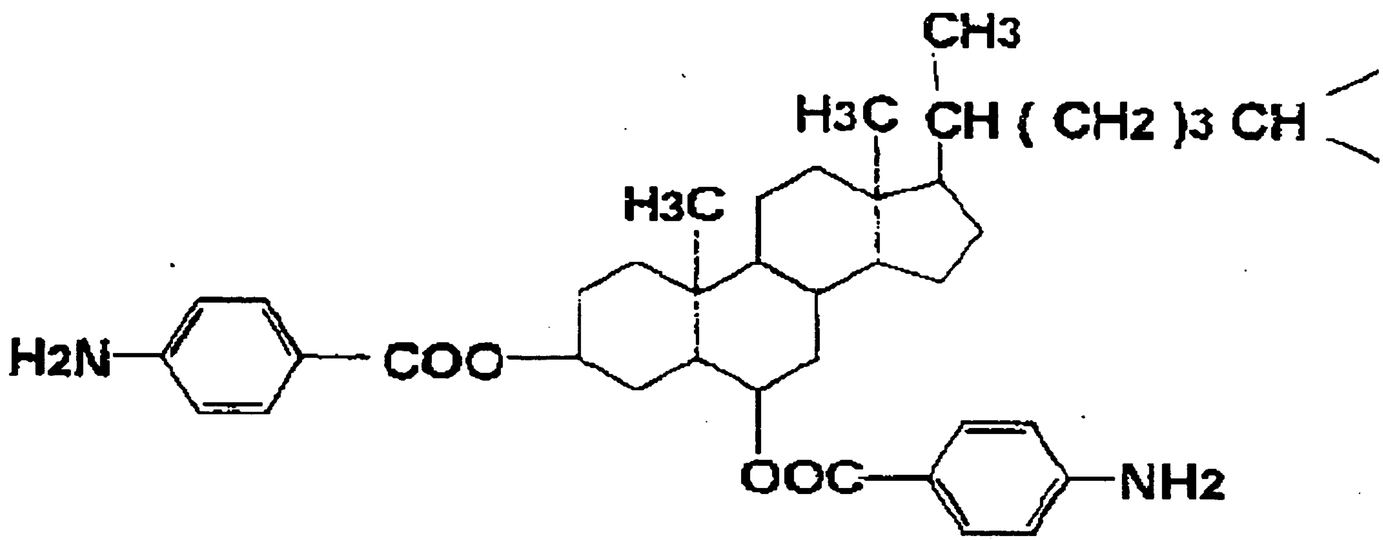
(R12 shows among a formula the divalent organic radical chosen from -O-, -COO-, -OCO-, -NHCO-, -CONH-, and -CO-, and R13 shows the univalent organic radical which has the radical chosen from a steroid frame, a trifluoromethyl radical, and a fluoro

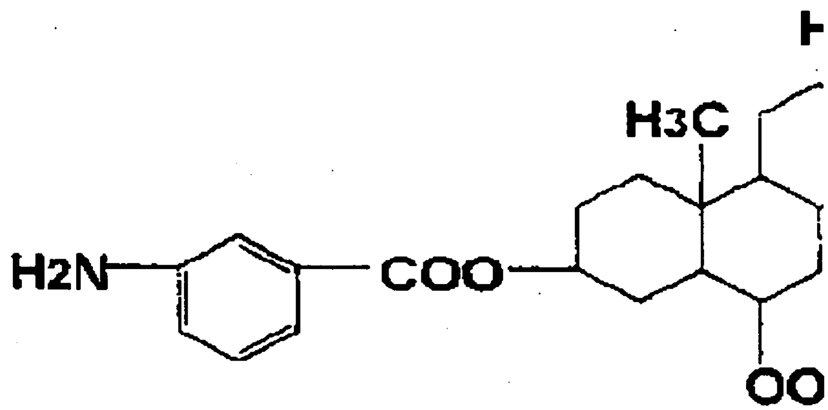
radical, or the alkyl group of carbon numbers 6–30.)

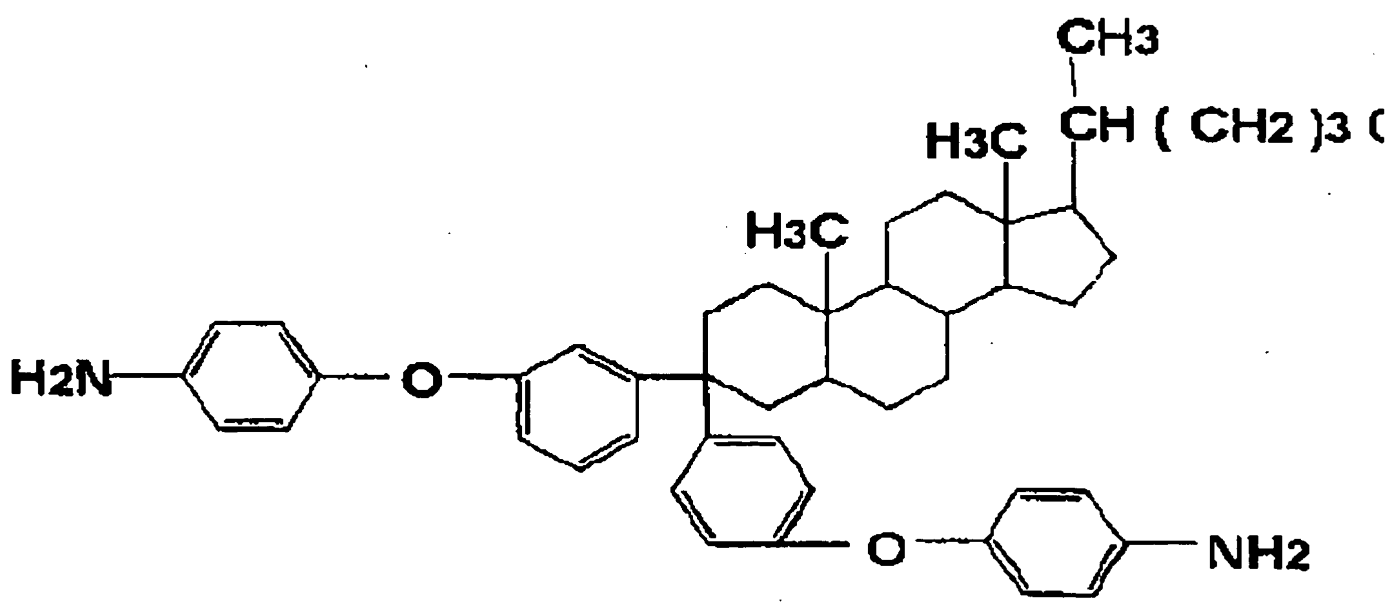
[0040] The following type (15) The compound expressed with – (27) can be mentioned. These diamine compounds are independent, or can be combined two or more sorts and can be used.

[0041]

[Formula 18]



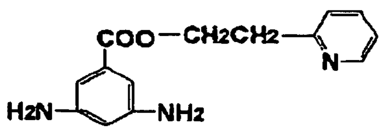




(y is the integer of 2-12 among a formula, and z is the integer of 1-5.)

[0042]

[Formula 19]



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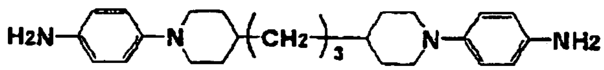

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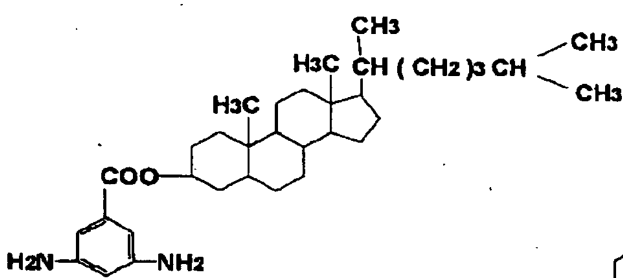

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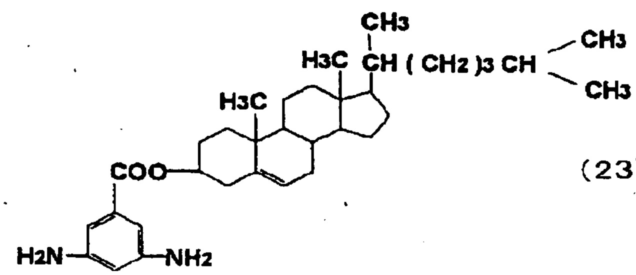

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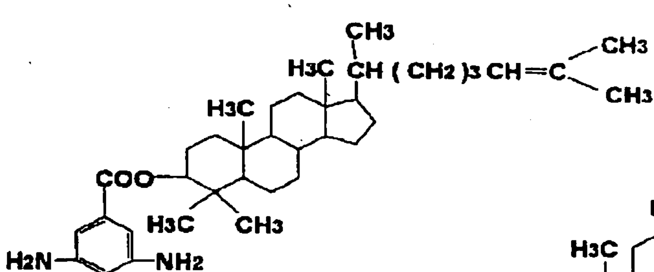

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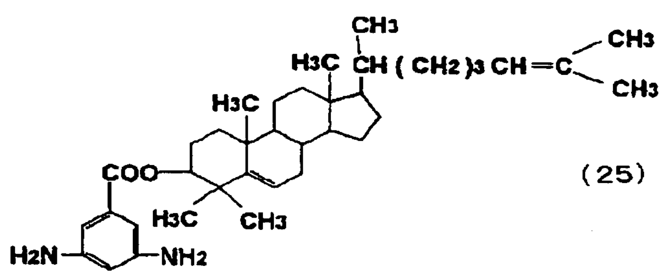

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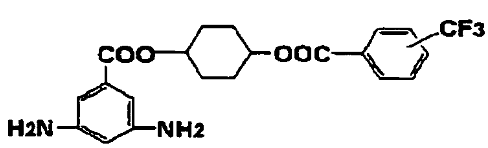

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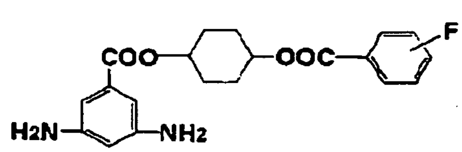

(27)

[0043] Among these 1, 4-diamino cyclohexane, isophorone diamine, 1-hexa deca NOKISHI -2, 4-diaminobenzene, tetrahydro dicyclopentadienylene diamine, Hexahydro -4, 7-methano INDANIREN dimethylene diamine, and tricyclo [6. 2.1.02, 7]-undecylene dimethydiamine, 4 and 4'-methylenebis (cyclohexylamine), 1, 3-screw aminomethyl cyclohexane, 2, 5-bis(aminomethyl) bicyclo [2.2.1] heptane, 2, a 6-bis(aminomethyl) bicyclo [2.2.1″] heptane, - diamino diphenyl sulfide, and 4 and 4 '4, 4'-diaminodiphenyl sulfone, 4 and 4'-diamino diphenyl ether, 3, 5-diamino benzoic acid, 2 and 2-screw (4-aminophenyl) - 1, 1, 1, 3, 3, and 3-hexafluoropropane, - diamino diphenylmethane, and p-phenylene diamine, 4, and 4 '4, 4'-diamino bibenzyl, 3 and 3' — the - dimethyl -4 and 4' — a - diamino biphenyl, 2, and 2-bis[4-(4-amino phenoxy) phenyl] propane — 1, 4-bis(4-amino phenoxy) benzene, 1, 3-bis(4-amino phenoxy) benzene, A 1, 3-bis(3-amino phenoxy) benzene, 9, and 9-bis(4-aminophenyl)-10-hydronalium anthracene, A 2, 7-diamino fluorene, 9, and 9-bis(4-aminophenyl) fluorene, 3 and 3'-dimethoxy -4, - diamino biphenyl, and 4 '4, 4'-(p-phenylene diisopropylidene) dianyline, 4 and 4'-(m-phenylene diisopropylidene) dianyline, 1, and 1-meta-xylylene diamine, 1,3-propanediamine, a tetramethylenediamine, pentamethylene diamine, The compound expressed with hexamethylenediamine, heptamethylene diamine, octamethylene diamine, nonamethylene diamine, 4, and 4-diamino heptamethylene diamine and above-mentioned formula (15) - (27) is desirable. Such diamines are independent or can be used combining two or more sorts.

[0044] 0-200 degrees C of reactions in Process A, Process B, and Process C are more preferably performed under 0-100-degree C temperature conditions into an organic solvent. If the polyamic acid to generate may be dissolved as an organic solvent used for this reaction, there is especially no limit, for example, it can mention phenol system solvents, such as non-proton system polar-solvent;m-cresol, such as a N-methyl-2-pyrrolidone, N,N-dimethylacetamide, N.N-dimethylformamide, dimethyl sulfoxide, gamma-butyrolactone, tetramethylurea, and hexamethylphosphortriamide, a xylenol, a phenol, and a halogenation phenol. As for the amount of the organic solvent used, it is desirable that the total amount of tetracarboxylic acid and diamine is 0.1 - 30% of the weight of an amount which becomes comparatively to the whole quantity of a reaction solution. In this organic solvent, the alcohols which are poor solvents, ketones, ester, ether, halogenated hydrocarbon, and hydrocarbons can be used together at a rate which is extent in which the polyamic acid prepolymer to generate does not deposit. As this poor solvent, ethyl alcohol, a cyclohexanol, propylene glycol, an acetone, a methyl ethyl ketone, methyl isobutyl ketone, a cyclohexanone, ethyl acetate, butyl acetate, a diethyl malonate, diethylether, ethylene glycol methyl ether, ethylene glycol ethyl ether, the ethylene glycol-propyl ether, ethylene glycol ethyl ether acetate, a tetrahydrofuran, a dichloroethane, a chlorobenzene, a hexane, a heptane, toluene, a xylene, etc. can be

mentioned, for example.

[0045] The imide-ized reaction in Process B dissolves the intermediate product (polyamic acid) in a reaction formula 2 in an organic solvent, and is performed by the approach of adding a dehydrating agent and a dehydration ring closure catalyst, and heating if needed in this solution. Moreover, the polyimide which carried out the dehydration ring closure reaction partially can also be suitably used by choosing a dehydration ring closure reaction condition in Process B. As a dehydrating agent, acid anhydrides, such as an acetic anhydride, a propionic anhydride, and anhydrous trifluoroacetic acid, can be used, for example. As for the amount of the dehydrating agent used, it is desirable to consider as 0.01–20 mols to one mol of repeat units of polyamic acid. Moreover, as a dehydration ring closure catalyst, tertiary amine, such as a pyridine, a collidine, a lutidine, and triethylamine, can be used, for example. However, it is not limited to these. As for the amount of the dehydration ring closure catalyst used, it is desirable to consider as 0.01–10 mols to one mol of dehydrating agents to be used. In addition, the organic solvent illustrated previously can be mentioned as an organic solvent used for a dehydration ring closure reaction. And 0–180 degrees C of reaction temperature of a dehydration ring closure reaction are usually preferably made into 10–150 degrees C.

[0046] It **, and these block copolymers become the thing equipped with the property of two or more classes which the homopolymer of the polyamic acid concerning each block or polyimide has while having an original property as polyamic acid or polyimide fundamentally, since the polyimide system block of two sorts from which structure differs mutually, or three sorts or more of two or more classes, and a polyamic acid system block are combined. That is, when the 1st polyimide component and the 2nd polyamic acid component live together in a molecule as a block respectively, for example, it has in coincidence the 1st property which the homopolymer of the polyimide which constitutes the 1st block concerned has, and the 2nd property which the homopolymer of the polyamic acid which constitutes the 2nd block has. Or it can be said that the property of the block copolymer concerned becomes a thing in the condition that the property of the homopolymer of the polyimide which constitutes a certain block denaturalized with the property of the homopolymer of the polyamic acid which constitutes other blocks.

[0047] Such a property cannot be acquired depending on the mere mixture of the 1st polyimide and the 2nd polyamic acid, and also when all the tetracarboxylic acid and diamines that are used in order to obtain [and] the 1st polyimide and 2nd polyamic acid are made to react, for example in package, it cannot be acquired. That is, it can be said that the block copolymer of this invention is a copolymer which has two or more good properties of both with it difficult [to obtain to coincidence with the usual means].

[0048] The property of the block copolymer of this invention becomes settled with how, and the repeat number of unit or its rate of the structure of the repeat unit in each block which constitutes it. Therefore, it is possible by controlling those factors to control the property of the polyimide system block copolymer finally obtained.
[0049] That is, if the number, each classes, and those rates of the block which should constitute the block copolymer obtained by choosing the class of the tetracarboxylic acid with which generation of each block is presented, and diamine, and adjusting the amount used or an operating rate are controlled, it is possible to control the property of the block copolymer finally obtained by this.
[0050] A <liquid crystal orientation agent>, next the liquid crystal orientation agent using the above-mentioned block copolymer are explained. Although the content rate of the block polymer in the liquid crystal orientation agent of this invention is chosen in consideration of viscosity, volatility, etc., let it preferably be 1 – 10% of the weight of the range still more preferably 0.1 to 20% of the weight to the liquid crystal orientation whole agent. Namely, although the coat which is an orientation film ingredient by applying to a substrate front face the liquid crystal orientation agent which consists of a polymer solution by print processes, a spin coat method, etc., and subsequently drying this is formed When the content rate of a polymer is less than 0.1 % of the weight When thickness of this coat may be unable to become [too little], may be unable to obtain the good liquid crystal orientation film and exceeds 20 % of the weight, the thickness of a coat becomes excessive, and about the good liquid crystal orientation film, it may be difficult to get and may become what the viscosity of a liquid crystal orientation agent increases and is inferior to a spreading property.
[0051] In addition, although the liquid crystal orientation agent used by this invention is characterized by including the block copolymer of specific structure, it is the range which does not spoil the effectiveness of this invention, and other polyamic acid and/or polyimide of structure can also be mixed and used for it.
[0052] As an organic solvent in which a polymer is dissolved, especially if a polymer can be dissolved, it is not restricted, and the solvent illustrated as what is used for the synthetic reaction and dehydration ring closure reaction of polyamic acid can be mentioned. Moreover, the poor solvent illustrated as what can be used together in the case of the synthetic reaction of polyamic acid can also be chosen suitably, and can be used together. In addition, when applying the liquid crystal orientation agent of this invention by the ink jet method, it is desirable to make the content of N-methyl pyrrolidone into 20 or less % of the weight of the total amount of solvents from a viewpoint which suppresses damage on an equipment member.
[0053] The functionality silane content compound and the epoxy compound may be blended from a viewpoint which raises further the adhesive property on a polymer and

the front face of a substrate applied as for the liquid crystal orientation agent used for this invention. As such a functionality silane content compound For example, 3-aminopropyl trimethoxysilane, 3-aminopropyl triethoxysilane, 2-aminopropyl trimethoxysilane, 2-aminopropyl triethoxysilane, N-(2-aminoethyl)-3-aminopropyl trimethoxysilane, N-(2-aminoethyl)-3-aminopropyl methyl dimethoxysilane, 3-ureido propyltrimethoxysilane, 3-ureido propyl triethoxysilane, N-ethoxycarbonyl-3-aminopropyl trimethoxysilane, N-ethoxycarbonyl-3-aminopropyl triethoxysilane, N-triethoxy silyl propyl TORIECHIREN triamine, N-trimethoxysilylpropyl TORIECHIREN triamine, 10-trimethoxysilyl - 1, 4, 7-thoria ZADEKAN, 10-triethoxy silyl - 1, 4, 7-thoria ZADEKAN, 9-trimethoxysilyl -3, 6-diaza nonyl acetate, 9-triethoxy silyl -3, 6-diaza nonyl acetate, N-benzyl-3-aminopropyl trimethoxysilane, N-benzyl-3-aminopropyl triethoxysilane, N-phenyl-3-aminopropyl trimethoxysilane, N-phenyl-3-aminopropyl triethoxysilane, N-bis(oxyethylene)-3-aminopropyl trimethoxysilane, N-bis(oxyethylene)-3-aminopropyl triethoxysilane, etc. can be mentioned.

[0054] As an epoxy group content compound, for example Moreover, ethylene glycol diglycidyl ether, Polyethylene glycol diglycidyl ether, propylene glycol diglycidyl ether, Tripropylene glycol diglycidyl ether, polypropylene glycol diglycidyl ether, Neopentyl glycol diglycidyl ether, 1, 6-hexanediol diglycidyl ether, Glycerol diglycidyl ether, 2, and 2-dibromoneopentylglycol diglycidyl ether, one — three — five — six - tetraglycidyl ether - two — four - hexandiol — N — N — N — ' — N — ' - tetraglycidyl ether - meta xylene — diamine — 1, a 3-bis(N and N-diglycidyl aminomethyl) cyclohexane, N, N, N', N' and - tetraglycidyl ether -4, 4'-diamino diphenylmethane, 3-(N-ant roux N-glycidyl) aminopropyl trimethoxysilane, 3-(N and N-diglycidyl) aminopropyl trimethoxysilane, etc. can be mentioned as a desirable thing. The compound which has the 3rd class nitrogen atom in intramolecular is [among these] desirable. The blending ratio of coal of these compounds is usually 0.1 - 30 weight section preferably below 40 weight sections to the polymer 100 weight section.

[0055] The liquid crystal display component of this invention obtained using the liquid crystal orientation agent in <liquid crystal display component> this invention can be manufactured by the following approach.

[0056] (1) Apply a liquid crystal orientation agent to the transparence electric conduction film side of the substrate with which the transparence electric conduction film by which patterning was carried out was prepared by approaches, such as for example, the roll coater method, the spinner method, and print processes, and form a coat by subsequently heating a spreading side. As a substrate, the transparence substrate which consists of plastic film, such as glass, such as a float glass and soda glass, polyethylene terephthalate, polybutylene terephthalate, polyether sulphone, and a

polycarbonate, etc., for example can be used here. As transparence electric conduction film prepared in the whole surface of a substrate, the NESA film which consists of SnO_2, for example, the ITO film which consists of $In_2O_3-SnO_2$ can be used. The photo etching method, the approach using a mask, etc. are beforehand used for patterning of these transparence electric conduction film.

[0057] In order to make still better the adhesive property of a substrate and the transparence electric conduction film, and a paint film on the occasion of spreading of a liquid crystal orientation agent, a functionality silane content compound, titanate, etc. can also be beforehand applied on a substrate and the transparence electric conduction film. Although the method of spreading has a flexographic printing method more in use than before, it can also apply ink jet print processes not to mention a flexographic printing method in the liquid crystal orientation agent of this invention. Moreover, the drying temperature of a paint film is 80-250 degrees C preferably, and is 120-200 degrees C more preferably. 0.001-1 micrometer of thickness of the coat formed is usually 0.005-0.5 micrometers preferably.

[0058] By performing rubbing processing ground in the fixed direction with the roll which twisted the cloth which consists a coat front face of fiber, such as nylon, rayon, and a cotton, the orientation ability of a liquid crystal molecule is given to a coat, and the formed coat turns into liquid crystal orientation film. In addition, in order to remove the pulverized coal (foreign matter) generated in the case of rubbing processing and to make a coat front face into a pure condition, it is desirable to wash the formed liquid crystal orientation film by isopropyl alcohol etc. Moreover, the liquid crystal orientation film can also be formed by the approach of obtaining a coat by the approach of irradiating polarization ultraviolet rays, an ion beam, an electron beam, etc., and giving orientation ability to a coat front face in addition to the approach by rubbing processing, a uniaxial-stretching method, a Langmuir-Blodgett's technique, etc.

[0059] On the liquid crystal orientation film formed of the above-mentioned processing, moreover, for example, JP,8-234207,A, As [show / in JP,7-168187,A, JP,6-222366,A, or JP,6-281937,A] How to perform processing to which a pre tilt angle is changed by irradiating ultraviolet rays, an ion beam, and an electron beam partially, Or form the resist film partially on the liquid crystal orientation film by which orientation processing was carried out [above-mentioned] as shown in JP,5-107544,A, and after performing orientation processing in the different direction from the direction of liquid crystal orientation of precedence, said resist film is removed. It is possible to improve the field-of-view property of a liquid crystal display component by the approach of performing processing to which the orientation ability of the liquid crystal orientation film is changed.

[0060] (3) the direction of a pre tilt angle [in / two substrates with which the liquid

crystal orientation film was formed as mentioned above are created, and / each liquid crystal orientation film] — a rectangular cross — or — reverse — so that it may become parallel Two substrates are made to counter through a gap (cel gap), it is filled up with liquid crystal in the cel gap divided by the front face and sealing compound of lamination and a substrate using the sealing compound in the periphery of two substrates, a restoration hole is closed, and a liquid crystal cell is constituted. And a liquid crystal display component is obtained by sticking so that it is in agreement or may intersect perpendicularly with the outside surface of liquid crystal orientation of a liquid crystal cell, i.e., the direction of the liquid crystal orientation film of each substrate which constitutes a liquid crystal cell with which the polarization direction was formed in the whole surface of the substrate concerned in the polarizing plate on the other hand at the side. As the above-mentioned sealing compound, the epoxy resin which contained the curing agent and the aluminum-oxide ball as a spacer, for example can be used.

[0061] As the above-mentioned liquid crystal, pneumatic mold liquid crystal and smectic mold liquid crystal can be mentioned, for example. Also in it, pneumatic mold liquid crystal is desirable, for example, the Schiff base system liquid crystal, azoxy series liquid crystal, biphenyl liquid crystal, phenylcyclohexane system liquid crystal, ester system liquid crystal, terphenyl liquid crystal, biphenyl cyclohexane liquid crystal, pyrimidine liquid crystal, dioxane system liquid crystal, bicyclo octane system liquid crystal, cubane system liquid crystal, etc. are used. Moreover, a chiral agent which is sold as cholesteric liquid crystal, such as for example, KORESU chill chloride, KORESUTERIRUNONAETO, and cholesteryl carbonate, a trade name "C-15", and "CB-15" (Merck Co. make) can also be added and used for such liquid crystal. Furthermore, ferroelectric liquid crystals, such as p-DESHIROKISHI benzylidene-p-amino-2-methylbutyl cinnamate, can also be used.

[0062] Moreover, as a polarizing plate used for the outside of a liquid crystal cell, the polarizing plate which consists of the polarizing plate or the H film itself which sandwiched the polarization film called H film which made iodine absorb by the cellulose acetate protective coat can be mentioned, carrying out extension orientation of the polyvinyl alcohol.

[0063]

[Example] Hereafter, although an example explains this invention still more concretely, this invention is not restricted to these examples. The performance-evaluation approach at the time of using for the property of the liquid crystal orientation agent produced by the following examples and examples of a comparison and a liquid crystal display component application is shown below.

[0064] It made into the soluble index which to have added to it until precipitate generated the butyl cellosolve used as the poor solvent to liquid crystal orientation

agent 50g adjusted as a gamma-butyrolactone solution of the 4 % of the weight of the [solubility of block copolymer] solid content concentration, and for butyl cellosolve to have added to it. Solubility is so good that there are many additions.

[0065] The volume from which desiccation thickness becomes 800A to an ITO substrate about a liquid crystal orientation agent using the equipment of a JET-CM continuous system ink jet printer (Kishu Giken Kogyo Co., Ltd. make) in the orientation agent solution adjusted to 2 % of the weight of [ink jet spreading nature] solid content concentration was applied. Subsequently, it was made to dry at 180 degrees C, and the irregularity of the desiccation film was measured by the sensing-pin type thickness gage, and the difference of the maximum thickness and the minimum thickness was made into thickness homogeneity, and was evaluated. Moreover, by comparing the thickness homogeneity at the time of initiation of ink jet spreading, and the 5-hour continuation spreading time, the stability of printing was evaluated and the case where the difference of the time of initiation and 5 hours after was 50A or less was made good.

[0066] The existence of the abnormality domain in the liquid crystal cell at the time of making the [stacking tendency of liquid crystal] liquid crystal display component turn an electrical potential difference on and off was observed under the microscope, and the case where there was no abnormality domain was judged to be "fitness."

[0067] [Pre tilt angle of liquid crystal display component] "T. Based on the approach of a publication, it measured with the crystal rotation method using helium-Ne laser light to J.Schffer, et.al., J.Appl.Phys., vol.19, and 2013(1980)."

[0068] After impressing the electrical potential difference of 5V to a [electrical-potential-difference retention of liquid crystal display component] liquid crystal display component by the span of the impression time amount for 60 microseconds, and 500 mses, the electrical-potential-difference retention after 500 mses was measured from impression discharge. a measuring device — TOYO Make — VHR-1 was used and it carried out at 60 degrees C.

[0069] After impressing direct-current-voltage 20V to a [after-image blanking time of liquid crystal display component] liquid crystal display component for 24 hours, the electrical potential difference was set to OFF, and time amount until an after-image eliminates visually was measured.

[0070] Preparation pyromellitic acid 2 anhydrides [of the synthetic example 1 <process A> polyamic acid prepolymer]g [64.14], 1, 2, and 3, 4-cyclobutane tetracarboxylic dianhydride 134.56 and 4, and 4'-diamino diphenylmethane 198.27g was dissolved in 1600g of N-methyl-2-pyrrolidones, and this solution was made to react at 20 degrees C for 6 hours. subsequently, the thing for which the acetone of an overlarge is filled with the obtained reaction solution, a resultant is settled, and precipitate, separation, washing, and desiccation of a resultant are performed — a logarithm — polyamic acid prepolymer

(A−1) 400.3g which has an amino group at the molecule end of viscosity (etaln) 1.8 dl/g was obtained.

[0071] The preparation 1, 3, 3a, 4, and 5 of <Process B> polyimide prepolymer, 9b−hexahydro−8−methyl −5 −(tetrahydro − 2, 5−dioxo−3−furanyl)− The [1 and 2−naphth c] furan −1, 3−dione 146.48g, 6.96g of compounds expressed with 46.56g of p−phenylene diamines and the above−mentioned formula (16) was dissolved in 800g of N−methyl−2−pyrrolidones, and this solution was made to react at 20 degrees C for 26 hours. Subsequently, the acetone of an overlarge was filled with the obtained reaction solution, and the resultant (polyamic acid prepolymer) was settled. Obtained polyamic acid prepolymer 120.0g was dissolved in 600g of gamma−butyrolactone, pyridine 44g and 56g of acetic anhydrides were added, and the dehydration ring closure was carried out at 60 degrees C for 2 hours. subsequently, the thing for which precipitate, separation, washing, and desiccation of a resultant are performed — a logarithm — polyimide prepolymer (B−1) 97.2g which has an acid−anhydride radical at the molecule end of viscosity (etaln) 0.76 dl/g and 90% of rates of imide−izing was obtained.

[0072] Polyamic acid prepolymer (A−1) 80g obtained by the production process A of <Process C> block copolymer and polyimide prepolymer (B−1) 20g obtained at Process B were dissolved in gamma−butyrolactone, and it considered as the solution of 4 % of the weight of solid content concentration. The viscosity of a solution was 17 mPa−s. This was made to react at 40 degrees C for 24 hours, and the solution of a block copolymer was obtained. the logarithm of the block copolymer (1) which the viscosity of the solution after a reaction is 20 mPa−s, and was obtained — viscosity (etaln) was 1.64 dl/g.

[0073] The polyamic acid prepolymer (A−1) was obtained like the process A of the example 1 of preparation composition of the synthetic example 2 <process A> polyamic acid prepolymer.

[0074] About the raw material used for preparation composition of <Process B> polyimide prepolymer, it is 1, 3,a [3], 4, 5, and 9b−hexahydro−8−methyl. − 5 −(tetrahydro − 2, 5−dioxo−3−furanyl)− The [1 and 2−naphth c] furan −1, 3−dione 132.31g, It reacts like the process B of the synthetic example 1 except having changed into 25.4g of compounds expressed with 4 and 4'−diamino diphenylmethane 11.92g, 30.35g of p−phenylene diamines, and the above−mentioned formula (20). a logarithm — polyimide prepolymer (B−2) 25.3g which has an acid−anhydride radical at the molecule end of viscosity (etaln) 0.73 dl/g and 94% of rates of imide−izing was obtained.

[0075] Polyamic acid prepolymer (A−1) 80g obtained by the production process A of <Process C> block copolymer and polyimide prepolymer (B−2) 20g obtained at Process B were dissolved in gamma−butyrolactone, and it considered as the solution of 4 % of the weight of solid content concentration. The viscosity of a solution was 17 mPa−s. This was made to react at 40 degrees C for 24 hours, and the solution of a block copolymer

was obtained. the logarithm of the block copolymer (2) which the viscosity of the solution after a reaction is 20 mPa-s, and was obtained — viscosity (etaln) was 1.65 dl/g.
[0076] The polyamic acid prepolymer (A-1) was obtained like the process A of the example 1 of preparation composition of the synthetic example 3 <process A> polyamic acid prepolymer.
[0077] The preparation 1, 3, 3a, 4, and 5 of <Process B> polyimide prepolymer, 9b-hexahydro-8-methyl -5 -(tetrahydro - 2, 5-dioxo-3-furanyl)- The [1 and 2-naphth c] furan -1, 3-dione 267.16g, 2, 3, 33.63g of 5-TORIKARUBOKI gardenia fruit clo pentyl acetic-acid 2 anhydrides, 24.9g of compounds expressed with p-phenylene diamineg [72.1] and 4 and 4'-diamino diphenylmethane 47.21g and the above-mentioned formula (16) was dissolved in 1800g of N-methyl-2-pyrrolidones, and this solution was made to react at 20 degrees C for 26 hours. Subsequently, the acetone of an overlarge was filled with the obtained reaction solution, and the resultant (polyamic acid prepolymer) was settled. Obtained polyamic acid prepolymer 30.0g was dissolved in 150g of gamma-butyrolactone, pyridine 11g and 14g of acetic anhydrides were added, and the dehydration ring closure was carried out at 60 degrees C for 2 hours. subsequently, the thing for which precipitate, separation, washing, and desiccation of a resultant are performed — a logarithm — polyimide prepolymer (B-3) 29.3g which has an acid-anhydride radical at the molecule end of viscosity (etaln) 0.66 dl/g and 90% of rates of imide-izing was obtained.
[0078] Polyamic acid prepolymer (A-1) 80g obtained by the production process A of <Process C> block copolymer and polyimide prepolymer (B-3) 20g obtained at Process B were dissolved in gamma-butyrolactone, and it considered as the solution of 4 % of the weight of solid content concentration. The viscosity of a solution was 16 mPa-s. This was made to react at 40 degrees C for 24 hours, and the solution of a block copolymer was obtained. the logarithm of the block copolymer (3) which the viscosity of the solution after a reaction is 20 mPa-s, and was obtained — viscosity (etaln) was 1.61 dl/g.
[0079] The polyamic acid prepolymer (A-1) was obtained like the process A of the example 1 of preparation composition of the synthetic example 4 <process A> polyamic acid prepolymer.
[0080] 49.78g of compounds expressed with preparation 2 and 3, 224.2g of 5-TORIKARUBOKI gardenia fruit clo pentyl acetic-acid 2 anhydrides, 92.7g of p-phenylene diamines, and the above-mentioned formula (16) of <Process B> polyimide prepolymer was dissolved in 2000g of N-methyl-2-pyrrolidones, and this solution was made to react at 60 degrees C for 6 hours. Subsequently, the acetone of an overlarge was filled with the obtained reaction solution, and the resultant (polyamic acid prepolymer) was settled. Obtained polyamic acid prepolymer 30.0g was dissolved in 200g of N-methyl-2-pyrrolidones, pyridine 17g and 11g of acetic anhydrides were added, and

the dehydration ring closure was carried out at 110 degrees C for 4 hours. subsequently, the thing for which precipitate, separation, washing, and desiccation of a resultant are performed — a logarithm — polyimide prepolymer (B-4) 28.3g which has an acid-anhydride radical at the molecule end of viscosity (etaln) 0.5 dl/g and 80% of rates of imide-izing was obtained.

[0081] Polyamic acid prepolymer (A-1) 80g obtained by the production process A of <Process C> block copolymer and polyimide prepolymer (B-4) 20g obtained at Process B were dissolved in gamma-butyrolactone, and it considered as the solution of 4 % of the weight of solid content concentration. The viscosity of a solution was 15 mPa-s. This was made to react at 40 degrees C for 24 hours, and the solution of a block copolymer was obtained. the logarithm of the block copolymer (4) which the viscosity of the solution after a reaction is 18 mPa-s, and was obtained — viscosity (etaln) was 1.60 dl/g.

[0082] The polyamic acid prepolymer (A-1) was obtained like the process A of the example 1 of preparation composition of the synthetic example 5 <process A> polyamic acid prepolymer.

The polyimide prepolymer (B-1) was obtained like the process B of the example 1 of preparation composition of <Process B> polyimide prepolymer.

[0083] Polyamic acid prepolymer (A-1) 60g obtained by the production process A of <Process C> block copolymer and polyimide prepolymer (B-1) 40g obtained at Process B were dissolved in gamma-butyrolactone, and it considered as the solution of 4 % of the weight of solid content concentration. The viscosity of a solution was 18 mPa-s. This was made to react at 40 degrees C for 24 hours, and the solution of a block copolymer was obtained. the logarithm of the block copolymer (5) which the viscosity of the solution after a reaction is 23 mPa-s, and was obtained — viscosity (etaln) was 1.70 dl/g.

[0084] The polyamic acid prepolymer (A-1) was obtained like the process A of the example 1 of preparation composition of the synthetic example 6 <process A> polyamic acid prepolymer.

The polyimide prepolymer (B-1) was obtained like the process B of the example 1 of preparation composition of <Process B> polyimide prepolymer.

[0085] Polyamic acid prepolymer (A-1) 30g obtained by the production process A of <Process C> block copolymer and polyimide prepolymer (B-1) 70g obtained at Process B were dissolved in gamma-butyrolactone, and it considered as the solution of 4 % of the weight of solid content concentration. The viscosity of a solution was 16 mPa-s. This was made to react at 40 degrees C for 24 hours, and the solution of a block copolymer was obtained. the logarithm of the block copolymer (6) which the viscosity of the solution after a reaction is 22 mPa-s, and was obtained — viscosity (etaln) was 1.60 dl/g.

[0086] Preparation pyromellitic acid 2 anhydrides [of the synthetic example 7 <process A> polyamic acid prepolymer]g [51.88] and 4 and 4'-diamino diphenylmethane 48.12g

was dissolved in 600g of N-methyl-2-pyrrolidones, and this solution was made to react at 20 degrees C for 6 hours. subsequently, the thing for which the acetone of an overlarge is filled with the obtained reaction solution, a resultant is settled, and precipitate, separation, washing, and desiccation of a resultant are performed — a logarithm — polyamic acid prepolymer (A-2) 95g which has an amino group at the molecule end of viscosity (etaln) 1.4 dl/g was obtained.

[0087] The polyimide prepolymer (B-1) was obtained like the process B of the example 1 of preparation composition of <Process B> polyimide prepolymer.

Polyamic acid prepolymer (A-2) 80g obtained by the production process A of <Process C> block copolymer and polyimide prepolymer (B-1) 20g obtained at Process B were dissolved in gamma-butyrolactone, and it considered as the solution of 4 % of the weight of solid content concentration. The viscosity of a solution was 15 mPa-s. This was made to react at 40 degrees C for 24 hours, and the solution of a block copolymer was obtained. the logarithm of the block copolymer (7) which the viscosity of the solution after a reaction is 18 mPa-s, and was obtained — viscosity (etaln) was 1.55 dl/g.

[0088] The polyamic acid prepolymer (A-1) was obtained like the process A of the example 1 of preparation composition of the synthetic example 8 <process A> polyamic acid prepolymer.

<Process B-1> The polyimide prepolymer (B-1) was obtained like the process B of the example 1 of preparation composition of the 1st polyimide prepolymer.

<Process B-2> The polyimide prepolymer (B-4) was obtained like the process B of the example 4 of preparation composition of the 2nd polyimide prepolymer.

[0089] Polyamic acid prepolymer (A-1) 80g obtained by the production process A of <Process C> block copolymer, polyimide prepolymer (B-1) 15g obtained at the process B-1, and polyimide prepolymer (B-4) 5g obtained at the process B-2 were dissolved in gamma-butyrolactone, and it considered as the solution of 4 % of the weight of solid content concentration. The viscosity of a solution was 16 mPa-s. This was made to react at 40 degrees C for 24 hours, and the solution of the block copolymer of a ternary system was obtained. the logarithm of the block copolymer (8) which the viscosity of the solution after a reaction is 19 mPa-s, and was obtained — viscosity (etaln) was 1.70 dl/g.

[0090] Synthetic example 9 <a process A-1> The polyamic acid prepolymer (A-1) was obtained like the process A of the example 1 of preparation composition of the 1st polyamic acid prepolymer.

224.17g screw [4-(4-amino phenoxy) phenyl] sulfone 432.5g of <process A-2> preparation [of the 2nd polyamic acid prepolymer] 2 and 3 and 5-TORIKARUBOKI gardenia fruit clo. pentyl acetic-acid 2 anhydrides was dissolved in 6000g of gamma-butyrolactone, and this solution was made to react at 60 degrees C for 6 hours. subsequently, the thing for which the acetone of an overlarge is filled with the obtained

reaction solution, a resultant is settled, and precipitate, separation, washing, and desiccation of a resultant are performed — a logarithm — polyamic acid prepolymer (A-3) 650g which has an amino group at the molecule end of viscosity (etaln) 1.5 dl/g was obtained.

[0091] The polyimide prepolymer (B-1) was obtained like the process B of the example 1 of preparation composition of <Process B> polyimide prepolymer.

Polyamic acid prepolymer (A-1) 60g obtained by the production process A-1 of <Process C> block copolymer, polyamic acid prepolymer (A-3) 20g obtained at the process A-2, and polyimide prepolymer (B-1) 20g obtained at Process B were dissolved in gamma-butyrolactone, and it considered as the solution of 4 % of the weight of solid content concentration. The viscosity of a solution was 18 mPa-s. This was made to react at 40 degrees C for 24 hours, and the solution of the block copolymer of a ternary system was obtained. the logarithm of the block copolymer (9) which the viscosity of the solution after a reaction is 20 mPa-s, and was obtained — viscosity (etaln) was 1.63 dl/g.

[0092] Preparation pyromellitic acid 2 anhydrides [of the synthetic example 10 <process A> polyamic acid prepolymer]g [26.37], 1, 2, and 3, 4-cyclobutane tetracarboxylic dianhydrideg [23.71] and 4, and 4'-diamino diphenyl ether 49.92g was dissolved in 900g of N-methyl-2-pyrrolidones, and this solution was made to react at 20 degrees C for 6 hours. subsequently, the thing for which the acetone of an overlarge is filled with the obtained reaction solution, a resultant is settled, and precipitate, separation, washing, and desiccation of a resultant are performed — a logarithm — polyamic acid prepolymer (A-4) 96.3g which has an amino group at the molecule end of viscosity (etaln) 1.6 dl/g was obtained.

[0093] The preparation 1, 3, 3a, 4, and 5 of <Process B> polyimide prepolymer, 9b-hexahydro-8-methyl -5 -(tetrahydro - 2, 5-dioxo-3-furanyl)- The [1 and 2-naphth c] furan -1, 3-dione 52.778g, 2, 3, 6.64g of 5-TORIKARUBOKI gardenia fruit clo pentyl acetic-acid 2 anhydrides, 5.01g of compounds expressed with p-phenylene diamineg [12.44] and 4 and 4'-(p-phenylene diisopropylidene) dianyline 23.13g and the above-mentioned formula (16) was dissolved in 800g of N-methyl-2-pyrrolidones, and this solution was made to react at 20 degrees C for 26 hours. Subsequently, the acetone of an overlarge was filled with the obtained reaction solution, and the resultant (polyamic acid prepolymer) was settled. Obtained polyamic acid prepolymer 100.0g was dissolved in 900g of gamma-butyrolactone, pyridine 62g and 141g of acetic anhydrides were added, and the dehydration ring closure was carried out at 60 degrees C for 2 hours. subsequently, the thing for which precipitate, separation, washing, and desiccation of a resultant are performed — a logarithm — polyimide prepolymer (B-5) 97.2g which has an acid-anhydride radical at the molecule end of viscosity (etaln) 0.73 dl/g and 90% of rates of imide-izing was obtained.

[0094] Polyamic acid prepolymer (A-4) 75g obtained by the production process A of <Process C> block copolymer and polyimide prepolymer (B-5) 25g obtained at Process B were dissolved in gamma-butyrolactone, and it considered as the solution of 4 % of the weight of solid content concentration. The viscosity of a solution was 20 mPa-s. This was made to react at 30 degrees C for 48 hours, and the solution of a block copolymer was obtained. the logarithm of the block copolymer (10) which the viscosity of the solution after a reaction is 27 mPa-s, and was obtained — viscosity (etaln) was 1.8 dl/g.
[0095] Preparation [of the synthetic example 11 <process A> polyamic acid prepolymer] 1, 2, and 3, 4-cyclobutane tetracarboxylic dianhydrideg [40.72] and 4, and 4'-diamino diphenyl ether 51.28g was dissolved in 900g of N-methyl-2-pyrrolidones, and this solution was made to react at 20 degrees C for 6 hours. subsequently, the thing for which the acetone of an overlarge is filled with the obtained reaction solution, a resultant is settled, and precipitate, separation, washing, and desiccation of a resultant are performed — a logarithm — polyamic acid prepolymer (A-5) 93g which has an amino group at the molecule end of viscosity (etaln) 1.6 dl/g was obtained.
[0096] The preparation 1, 3, 3a, 4, and 5 of <Process B> polyimide prepolymer, 9b-hexahydro-8-methyl -5 -(tetrahydro - 2, 5-dioxo-3-furanyl)- The [1 and 2-naphth c] furan -1, 3-dione 59.19g, 2, 3, 4.69g of 5-TORIKARUBOKI gardenia fruit clo pentyl acetic-acid 2 anhydrides, P-phenylene diamines 13.44g and 2, 2-screw (4-aminophenyl) - 1, 1, 1, 3, 3, and 3-hexafluoropropane 10.39g, 3.25g of compounds expressed with 4 and 4'-diamino diphenylmethane 9.04g and the above-mentioned formula (16) was dissolved in 300g of N-methyl-2-pyrrolidones, and this solution was made to react at 20 degrees C for 26 hours. Subsequently, the acetone of an overlarge was filled with the obtained reaction solution, and the resultant (polyamic acid prepolymer) was settled. Obtained polyamic acid prepolymer 100.0g was dissolved in 900g of gamma-butyrolactone, pyridine 65.2g and 84.2g of acetic anhydrides were added, and the dehydration ring closure was carried out at 60 degrees C for 2 hours. subsequently, the thing for which precipitate, separation, washing, and desiccation of a resultant are performed — a logarithm — polyimide prepolymer (B-6) 94g which has an acid-anhydride radical at the molecule end of viscosity (etaln) 0.58 dl/g and 95% of rates of imide-izing was obtained.
[0097] Polyamic acid prepolymer (A-5) 75g obtained by the production process A of <Process C> block copolymer and polyimide prepolymer (B-6) 25g obtained at Process B were dissolved in gamma-butyrolactone, and it considered as the solution of 4 % of the weight of solid content concentration. The viscosity of a solution was 14 mPa-s. This was made to react at 50 degrees C for 4 hours, and the solution of a block copolymer was obtained. the logarithm of the block copolymer (11) which the viscosity of the solution after a reaction is 21 mPa-s, and was obtained — viscosity (etaln) was 1.6 dl/g.
[0098] The examples 11, 3, 3a, 4, and 5 of comparison composition, 9b-hexahydro -5

-(tetrahydro - 2, 5-dioxo-3-furanyl)- The [1 and 2-naphth c] furan -1, 3-dione 34.7g, 10.41g [of p-phenylene diamines], 1-hexa deca NOKISHI -2, and 4-diaminobenzene 3.84g and 3-aminopropyl methyldiethoxysilane 1.05g were dissolved in 200g of N-methyl-2-pyrrolidones, and this solution was made to react at 20 degrees C for 24 hours. Subsequently, the acetone of an overlarge was filled with the obtained reaction solution, and the resultant was settled. 50.0g of obtained polymers was dissolved in 450g of gamma-butyrolactone, pyridine 5.0g and 10.8g of acetic anhydrides were added, and the dehydration ring closure was carried out at 50 degrees C for 3 hours. subsequently, the thing for which precipitate, separation, washing, and desiccation of a resultant are performed — a logarithm — viscosity (etaln) 0.72 dl/g and fusibility polyimide (polymer b) 47g of 90% of rates of imide-izing were obtained.

[0099] The polyamic acid prepolymer (A-3) was obtained like the process A-2 of the example 10 of preparation composition of the example of comparison composition 2 <process A> polyamic acid prepolymer.

The polyimide prepolymer (B-1) was obtained like the process B of the example 1 of preparation composition of <Process B> polyimide prepolymer.

[0100] Polyamic acid prepolymer (A-3) 80g obtained by the production process A of <Process C> block copolymer and polyimide prepolymer (B-1) 20g obtained at Process B were dissolved in gamma-butyrolactone, and it considered as the solution of 4 % of the weight of solid content concentration. The viscosity of a solution was 15 mPa-s. This was made to react at 40 degrees C for 24 hours, and the solution of a block copolymer was obtained. the logarithm of the block copolymer (i) which the viscosity of the solution after a reaction is 18 mPa-s, and was obtained — viscosity (etaln) was 1.50 dl/g.

[0101] The block copolymer (1) obtained in the example 1 of example 1 composition was dissolved in gamma-butyrolactone, it considered as the solution of 4 % of the weight of solid content concentration, this solution was filtered with the filter of 1 micrometer of apertures, and the liquid crystal orientation agent was prepared. When butyl cellosolve was added until precipitate arose in this liquid crystal orientation agent 50g, the added amount of butyls cellosolve was 20g, and the generated block copolymer was what is excellent in solubility.

[0102] Moreover, when the obtained liquid crystal orientation agent was diluted to 2 % of the weight of solid content concentration and having been printed with the ink jet printing machine, the difference (thickness homogeneity) of the maximum thickness and the minimum thickness was 70A, and was good. Subsequently, when continuation ink jet printing nature was tested, poor spreading was not seen but it was very stable with 30A. [of the thickness homogeneity difference at the time of printing initiation and termination (continuation printing nature)]

[0103] The liquid crystal orientation agent was applied to the transparent electrode side

of the glass substrate with a transparent electrode which consists of ITO film using the printing machine for liquid crystal orientation film spreading, it dried for 10 minutes on the 180-degree C hot plate, and the coat of 600A of desiccation average thickness was formed. The rubbing machine which has the roll which twisted the cloth made from rayon around this coat performed rubbing processing with engine-speed 400rpm of a roll, the passing speed of 3cm/second of a stage, and the length-of-hair length of penetration of 0.4mm. After the above-mentioned orientation film spreading substrate was immersed for 1 minute into isopropyl alcohol, both substrates were dried for 5 minutes on the 100-degree C hot plate.

[0104] Next, it piled up, the liquid crystal pinching substrate of a pair was stuck by pressure so that a liquid crystal orientation film surface might face and the direction of rubbing might moreover go direct, and each rim which has the liquid crystal orientation film of the liquid crystal pinching substrate with which orientation processing of the pair was carried out was made to harden adhesives, after carrying out screen-stencil spreading of the epoxy resin adhesive containing an aluminum-oxide ball with a diameter of 5.5 micrometers. Subsequently, from the liquid crystal inlet, after being filled up with pneumatic mold liquid crystal (the Merck Co. make, MLC-5081) between the substrates of a pair, the liquid crystal inlet was closed with acrylic photo-curing adhesives, and lamination and a liquid crystal display component were produced so that the polarization direction of a polarizing plate might be in agreement with the direction of rubbing of the liquid crystal orientation film of each substrate in a polarizing plate by both sides of the outside of a substrate.

[0105] When evaluated about the stacking tendency of the liquid crystal of the obtained liquid crystal display component, a pre tilt angle, electrical-potential-difference retention, and after-image elimination, the stacking tendency of liquid crystal was good, and after-image blanking time is 1 minute and a small value, and fulfilled the demand characteristics as liquid crystal orientation film. These results are shown in Table 1 and Table 2.

[0106] According to the formula shown in one to examples 2-12 and example of comparison 4 table 1, the liquid crystal orientation agent using the polymer and additive which were obtained in the synthetic examples 2-11 and the examples 1-2 of comparison composition was adjusted, except having changed liquid crystal into MLC-2012 in the example 4, orientation processing was performed like the example 1 and the liquid crystal display component was produced like the example 1. It evaluated [each / of the obtained liquid crystal display component] about the stacking tendency of liquid crystal, after-image blanking time, etc. A result is shown in Table 1 and Table 2.

[0107]

[Table 1]

	ﾌﾞﾛｯｸ化時の粘度変化		溶解性	インクジェット印刷性	
添加剤	反応前 (mPa/s)	反応後 (mPa/s)	ﾌﾞﾁﾙｾﾛｿﾙﾌﾞ添加量(g)	膜厚均一性 (Å)	連続印刷性 (Å)
N',N'-ﾃﾄﾗｸﾞﾘｼｼﾞﾙ-4,4-ｼﾞｱﾐﾉｼﾞﾌｪﾆﾙﾒﾀﾝ(0.2g)	17	20	30	50	30
なし	17	20	35	40	30
なし	16	20	35	40	20
なし	15	18	25	60	80
なし	18	23	20	70	90
なし	16	22	10	90	200
ﾉﾌﾟﾛﾋﾟﾙﾒﾁﾙｼﾞｴﾄｷｼｼﾗﾝ(0.1g)	17	18	30	30	20
なし	15	18	30	40	20
なし	16	19	25	60	40
なし	18	20	30	40	30

[0108]

[Table 2]

	プレチルト角（°）	電圧保持率（%）	残像消去時間（分）
実施例1	5	98	1
実施例2	4	97	1
実施例3	5	98	1.5
実施例4	88	98	2
実施例5	7	98	4
実施例6	7	98	6
実施例7	6	97	2
実施例8	4	97	7
実施例9	8	98	2
実施例10	5	98	10
実施例11	5	99	0.5
実施例12	5	99	0.3
比較例1	3	99	15
比較例2	5	99	1
比較例3	1	85	5
比較例4	8	99	13

[0109]

[Effect of the Invention] The following effectiveness is accepted from examples 1-12 and the examples 1-4 of a comparison. namely, — according to [although the only mixed liquid crystal orientation agent has problems, such as engine performance as poor spreading at the time of ink jet printing, poor printing grace, and a liquid crystal display component, or it uses polyamic acid and polyimide alone] the block copolymer of this invention — ink jet printing nature and many properties as a liquid crystal display component — all can be satisfied on high level. Therefore, according to this invention, it corresponds to ink jet printing promising for the yield improvement of a liquid crystal panel, and a cost cut. And by choosing the liquid crystal used besides the ability to use it suitable for TN mold and a STN mold liquid crystal display component since it can be satisfied with high level of the pre tilt angle required of a liquid crystal display component, electrical-potential-difference retention, and an after-image property It can be used suitable for the liquid crystal display component of SH (Super Homeotropic) mold, an IPS (In-PlaneSwitching) mold, a ferroelectricity, and antiferroelectricity etc. Moreover, since the block copolymer (11) which was divided and was used in the example 12 is excellent also in transparency, it is suitable for the reflective mold LCD and a projector application. Furthermore, the liquid crystal display component which has the liquid crystal orientation film prepared by this invention approach can be used effective in various equipments, for example, is used for displays, such as a desktop computer, a wrist watch,

a clock, a multiplier display board, a word processor, a personal computer, and a liquid crystal television.

[Translation done.]